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ABSTRACT

The introduction of computers and other microelectronic equipment throughout the Japanese economy has not affected employment negatively, owing to economic growth and the adaptability of the workers and business organizations affected. Because rapid advances in technology are making many specialized skills and areas of knowledge obsolete, it is becoming increasingly necessary to re-educate and retrain the labor force. Schools are now asked to focus on widely applicable theory rather than on specific skills or facts, and to develop students' fundamental scholastic aptitudes, adaptability, and creativity. The skills and knowledge required for work are provided at vocational schools or through internal programs operated by businesses themselves. The changes in the educational system that are necessitated by technological advancement challenge Japanese social and cultural values and will have a significant impact on the country. Data on employment trends in Japan support the arguments made in this paper. Appendixes describe Japan's educational system and the essential characteristics of the employment system in further detail. Forty-four references are provided. (PGD)

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## Institute for Research on Educational Finance and Governance

SCHOOL OF EDUCATION STANFORD UNIVERSITY

Program Report No. 85-B2

# EDUCATION AND TRAINING IN JAPAN IN THE CYBERNETIC AGE

Hiromitsu Muta

August 1985

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# EDUCATION AND TRAINING IN JAPAN IN THE CYBERNETIC AGE

Hiromitsu Muta

August 1985

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INSTITUTE FOR RESEARCH ON EDUCATIONAL
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## Abstract

Introduction of microelectronic equipment throughout the Japanese economy does not affect employment negatively so far owing to economic growth and the adaptability of workers and enterprises to advances. However, reeducation and retraining of workers have become essential. Because rapid advances in technology tend to make special skills and knowledge out of date, schools are expected to teach theories of wide application and to develop students' fundamental scholastic aptitude and adaptability. Skills and knowledge necessary in work are acquired at vocational schools or through in-house programs that enterprises offer. Technological development causes education to diversify in order to meet the various needs of society.

# I. INTRODUCTION

The current development and diffusion of computers and machinery based upon microelectronics (ME) are remarkable, and various changes, which might be called "the new industrial revolution," can be observed throughout society. Education and training cannot help being affected by this fact both directly and indirectly. In this paper the influence that the introduction of microelectronic technology gives to work in Japan, education and training, and the future of education and training will be discussed.

New advances in technology, development of microelectronics and others, have spread in various industries throughout the economy. Especially the development and diffusion of industrial robots are remarkable; industrial robots have been used to overcome the shortage of workers, to cope with unfavorable and dangerous environments, to improve productivity and to produce goods with better and more stable qualities. Moreover, personal computers, word processors, and other office automation equipment are common in offices.

In both cases manpower is replaced by machines, and this results in fewer opportunities for people to work. Yet the issue in Japan has not been a big problem in general because employee adaptability to technological development is quite high; reassignment caused by the introduction of new technology has been smoothly accomplished, supported by a life-long employment system and cooperative labor-management relationship. Furthermore, the investment for research and developmment and the expansion of business due to the development of new products has increased employment opportunities.

Nonetheless, the reassignment and reeducation of Japanese workers, which the introduction of new technology requires, are not easily accomplished. It is predicted that there will be an oversupply of craftsmen, production process workers and clerical workers, and an undersupply of sales workers, professional and technical workers, and service workers in Japan by the year 2000. The unemployment rate is presumed to rise due to the mistmatch of the supply and demand of workers and the incresed member of aged workers, who cannot easily be reassigned.

The use of microcomputers in education is expected to improve teaching methods, to enrich teaching materials and to facilitate an understanding of computers. Yet at present only some of the upper secondary schools and a few elementary schools and lower secondary schools are using microcomputers in Japan. Education on computers has been done in vocational programs of upper secondary schools as a part of curricula and is going to be expanded. Typical use would be data processing for students, progress records and the transaction of office work. Although computers can be used to teach existing subjects, this has not been diffused because of problems in developing software and reeducating teachers.

Development of high technology in Japan affects education not only because microelectronics equipment is imported to schools but rather because the role of education changes owing to the influence that the development of high technology has on society. What is studied at schools can become outdated quickly. Postsecondary education should be available for workers who need to go back to school to acquire new knowledge. Elementary and secondary education is expected to develop students' ability to adapt themselves to changes of society more than ever. Even at vocational programs of upper secondary schools, acquisition of the ability to adapt to changing industry and society is stressed more than skills and knowledge in a specific job area. The same educational policy can be seen in university and college education too. Job skills are acquired in programs of training and education that companies offer, at vocational schools, or at special training schools.

## II. IMPACTS OF HIGH TECHNOLOGY ON WORK

### 1. Characteristics of the Labor Force

The basic characteristics of the Japanese labor force are that workers are aged and highly educated and also that the number of female workers keeps increasing. In 1980 the proportion of workers aged over 55 in the labor force was 16.1%; this number is expected to increase drastically to 23.0% in the year 2000. Although workers aged between 15 to 24 will increase by 270,000, their proportion to the whole, which is 12.4% in 1980, is estimated to decrease to 11.3% in 2000 (Ministry of Labor, 1982). Also the number of university and college graduates among workers is increasing every year although the ratio of the students who go on to universities and colleges has stopped increasing and remains stable at 36%. It is predicted that the proportion of university or college graduates aged over 20, which is 15.9% in 1980 (male: 20.8%, female: 11.3%), will be 24.7% in 2000 (male: 29.7%, female: 20.0%). (Economic Council, Long-Term Outlook Committee, 1983b).

Thus the percentage of university and college graduates is increasing in all kinds of trades. Table 1 shows the increased number of employees who are university and college graduates by occupation, divided into the number caused by occupational factor and the number caused by educational factor. Obviously the increase of clerical workers, sales workers and production workers is caused mostly by educational factor. The increased demand for workers cannot absorb all the increasing number of university and college graduates, who have started taking jobs which used to be for secondary school graduates. This phenomenon has been showing a marked trend. While these university and college graduates raise the potential adaptability of the workplace to technological innovation, there is concern that they lose their morale to work and tend to change jobs.

The number of female workers has been increasing. It is partly due to the increase of the female population itself, but mainly to the increase of the proportion of women willing to work, which has grown

Table 1. Factor Analysis of Increase of University and College Graduates Among Employees

( unit: thousand )

| Classification | 1980 | 1970-1980 | | | | 1960-1970 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | total number | * increase | ** job factor | *** educational factor | **** both | * increase | ** job factor | *** educational factor | **** both |
| Professional & technical | 3183 | 1169 | 855 | 220 | 94 | 895 | 652 | 153 | 89 |
| Administrative & managerial | 1001 | 230 | 231 | -1 | 0 | 448 | 329 | 59 | 60 |
| Clerical | 2453 | 1136 | 373 | 594 | 168 | 548 | 457 | 57 | 34 |
| Sales | 1551 | 855 | 196 | 514 | 144 | 423 | 99 | 238 | 86 |
| Services & security | 363 | 198 | 27 | 148 | 24 | 92 | 30 | 44 | 18 |
| Transportation & communication | 100 | 39 | 3 | 35 | 1 | 29 | 21 | 5 | 3 |
| Skilled & production process | 1075 | 658 | 28 | 590 | 40 | 186 | 75 | 84 | 27 |
| Agricultural, Fishing Forestry & Mining | 121 | 31 | -35 | 109 | -43 | 14 | -22 | 51 | -15 |
| Others | 12 | 10 | 6 | 1 | 3 | 1 | 0 | 1 | 1 |
| Total | 9860 | 4326 | 1684 | 2210 | 432 | 2635 | 1640 | 692 | 303 |

Source: National Census 1960,1970,1980

Notes: Details may not add to totals due to rounding.

$$\underbrace{L_t^u - L_o^u}_{*} = \underbrace{(L_t - L_o)\cdot\frac{L_o^u}{L_o}}_{**} + \underbrace{L_o\cdot\left(\frac{L_t^u}{L_t} - \frac{L_o^u}{L_o}\right)}_{***} + \underbrace{(L_t - L_o)\cdot\left(\frac{L_t^u}{L_t} - \frac{L_o^u}{L_o}\right)}_{****}$$

$L_t$ :Total number of employees at t(time).

$L_t^u$ :Number of university and college graduates among employeess at t(time).



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ever since 1976. The reasons are: fewer women quit working when they get married or have babies; the average age to get married is older, increasing the percentage of unmarried female workers; the period spent for raising children is shortening because of a low birth rate and the availability of nursing accommodations. Also female workers' attitudes to their jobs have changed, and more women are willing to contribute to society through their work; the demand for a part-time labor force has increased, making it easier for housewives to work outside the home; and the small economic growth did not greatly increase the income of householders (Ministry of Labor, 1983, pp. 141-155).

### 2. New Technology

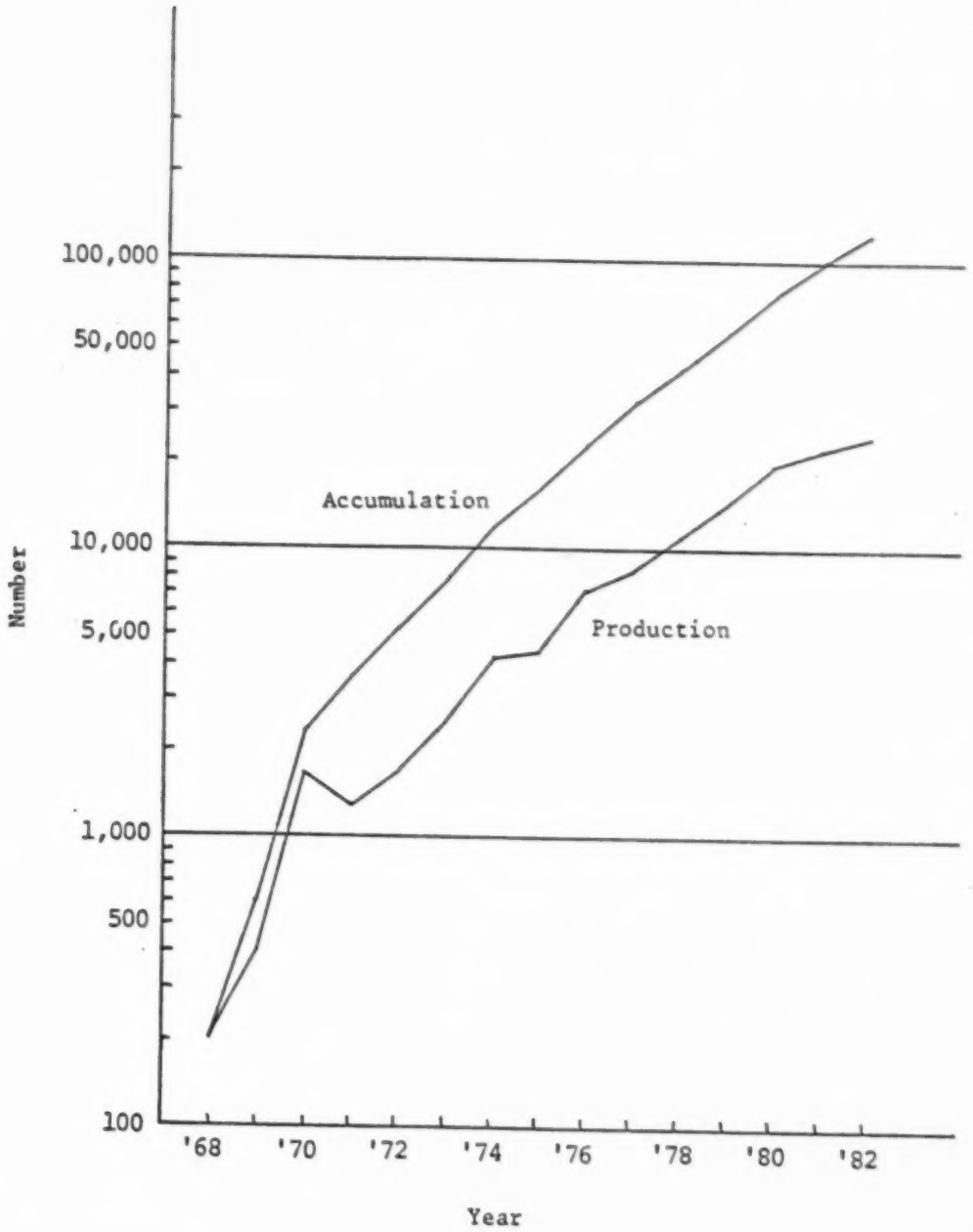
After World War II, the Japanese economy grew drastically, owing mainly to the importation of new technology. However, the price of oil increased due to the oil crisis, and enterprises came to emphasize research and development of technology such as production equipment which can be made with less energy or products which require less energy. Thus the balance of import from and export to developed countries in terms of technology has been in the black since 1980. In the ten years after the oil crisis, Japanese GNP increased 40% while the import of oil decreased 30%. The industrial structure also changed from heavy industry oriented to information industry oriented. The oil crisis was the trigger for Japan's changing to a highly developed information society.

The level of technology production in Japan is as high today as that of advanced Western countries, yet it is still necessary to keep making efforts to develop new advances in technology.

### 3. Diffusion of Microelectronic Equipment and Robots

Under these circumstances new advances in technology, development of microelectronics and others, have spread in various industries throughout the economy. Especially the diffusion of industrial robots is remarkable as shown in Figure 1. In 1982, 118,000 robots in a wide

Figure 1. Number of Industrial Robots




Source: Statistics of Japan Association of Industrial Robots

sense, including manual manipulator, were operated; 19,000 of them are play-back robots and more sophisticated ones, in other words robots in a narrow sense. In 1990 the number of robots in a wide sense is presumed to increase to be 557,000 which is more than four times their present number; and that of those in a narrow sense is estimated to increase to be 171,000, more than nine times the present number.

The proportion of play-back robots and more sophisticated ones to the total production in a year was only 8% in 1978, but had risen to 43% in 1982. This trend seems to continue along with the development and diffusion of intelligent robots, which meet the needs for automation of more complicated work processes (Ministry of International Trade and Industry, Committee for Research on the Trend of Robot Industry).

According to a survey conducted by the Ministry of Labor, Statistics and Information Department on 10,000 enterprises which are categorized into manufacturing industry (1983), 59.3% of total enterprises and 95.6% of enterprises who employ more than 1,000 workers have imported microelectronic equipment. The majority of the enterprises which employ microelectronic techniques deal with manufacturing industry. The reasons for importing robots are as follows: (1) to save labor; (2) to improve the working environment; (3) to cope with the shortage of skilled workers and young workers; (4) to improve the quality and precision of products; and (5) to adjust production.

Microelectronic techniques will be diffused in fields other than manufacturing industry such as atomic energy, marine development, social welfare and medicine as well. Also research on the development of robots able to perform the comoplicated tasks currently being done by people despite very unfavorable environments is making progress.

Robots are used not only in big enterprises, Although it used to be said that it is hard for small enterprises to modernize assembly lines because of their small capital and production systems, they started renovating production lines because: (1) advance of microelectronic technology improved the quality of automation equipment

and lowered their prices, (2) development of new products and production of goods with high quality are required to meet the needs of the parent company and market, and (3) small enterprises do not have enough skilled workers. According to a survey conducted by The Research and Development Institute of Vocational Training (1948a), 50.9% of small enterprises holding 30-299 workers which deal with metal and machinery production have introduced some automation equipment, although the percentage of the companies using sophisticated robots is yet low. Moreover, 18.4% of the enterprises are considering the importation of such equipment.

As Figure 2 shows, personal computers, word processors, facsimiles and other office automation instruments have been introduced into offices. A research study on 6,000 enterprises in nine major industries which employ more than 100 workers conducted by the Ministry of Labor, Policy Planning and Research Department reports that 81% have imported office appliances based on microelectronic principles. The percentage of the enterprises which own microelectronic instruments and ones which are planning to introduce them within 5 years in 89%. It is also reported that 51.4% of workers at managerial departments use office automation instruments.

### 4. Changes in Employment

Application of microelectronics affects employment in the following aspects.

(1) Factors to decrease employment opportunities:

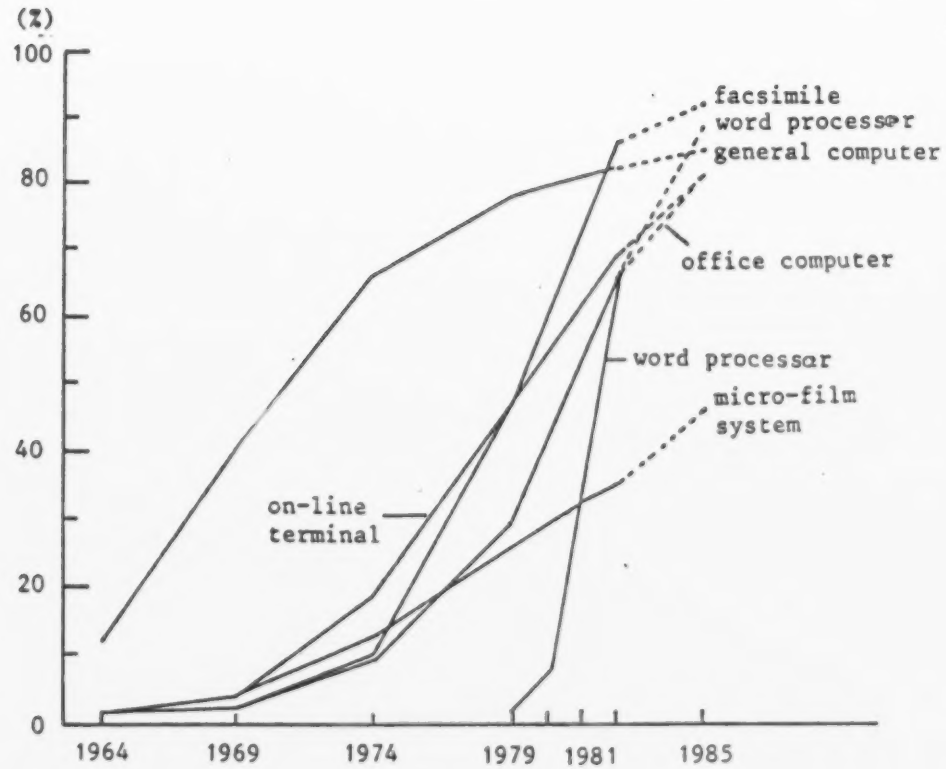
A) Higher productivity led by the importation of microelectronic technology decreases the amount of required labor.

B) A decreasing market share for existing products prompts their withdrawal from market, resulting in a decrease of related enterprises.

(2) Factors to increase employment opportunities:

A) Increasing demand for microcomputers, parts, microelectronic equipment themselves.

Figure 2. Ratio of Diffusion of Office Automation Instruments




Source : Economic Planning Agency, Strategies to Survive the Time of Confusion, 1983

B) Increasing demand for technical experts owing to investment in research and development, and the expansion of business.

In Japan expansion of microelectronic technology did not decrease employment opportunities in general because of the balance between these two aspects.

Adding to this the following facts are undeniable:

(1) The shortage of skilled and young workers still exists.

(2) The adaptability of well-educated workers to technological development is high.

(3) Reassignment caused by the introduction of new technology has been smoothly accomplished, supported by a lifelong employment system and cooperative labor-management relationships.

(4) Because working environments have been improved, a new field of employment for women and aged people has been opened.

At each enterprise, however, the introduction of new technology caused difficult problems to overcome. According to a survey by the Ministry of Labor, Statistics and Information Department, 48.0% of the enterprises decreased the number of workers with the importation of microelectronic equipment to the manufacturing process; 2.2% of them unmanned the process, 39.4% did not reshuffle the personnel and 10.0% increased the number of workers.

In a survey of mechanical industry enterprises conducted by the Japan Society for the Promotion of Mechanical Industry, the Economic Research Institute reports that at enterprises with more than 100 workers the problem of superfluous personnel decreases as the number of newly-employed workers rises. At companies with less than 100 workers the issue is regarded optimistically. (pp. 165-167)

According to research conducted by the Ministry of Labor, Policy Planning and Research Department, 43% of the enterprises increased the number of employees while 27% decreased it compared with five years ago. Only 2.7% identified "importation of office automation instruments" as the reason that caused the number of employees to decrease, but 5.6%

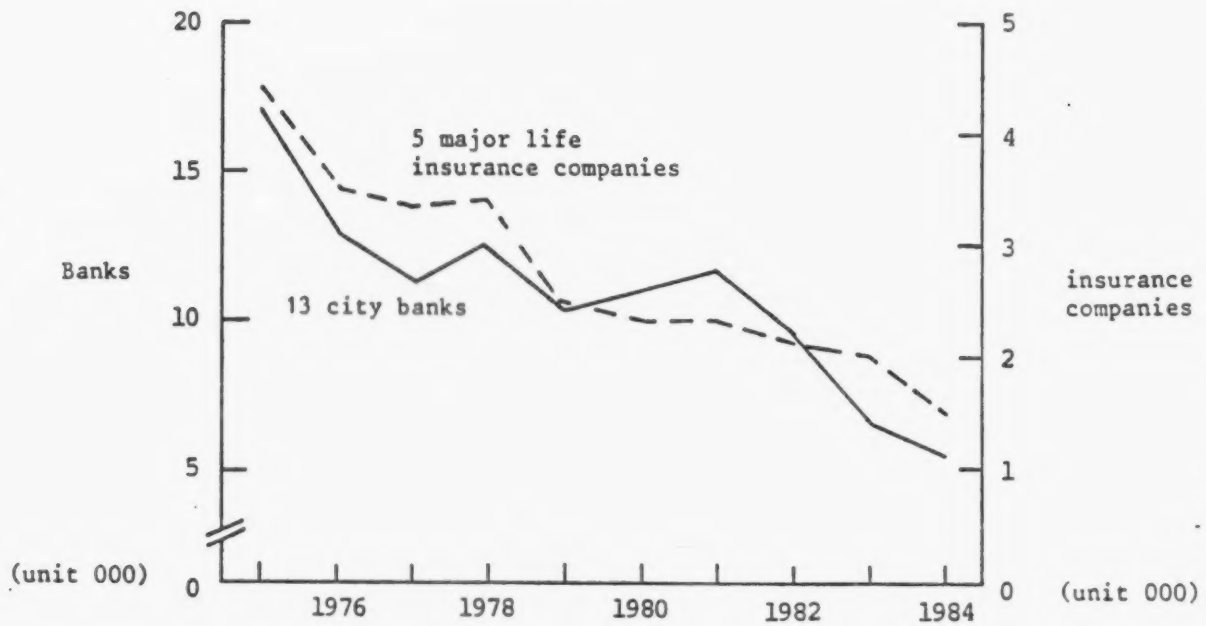
responded that the importation of office automation instruments would propel this tendency. The importation of office automation instruments seems to produce a more powerful influence on employment.

At banks and insurance companies where the importation of office automation instruments is most advanced, the number of new employees has decreased. 17,600 female workers were hired by city banks in 1975, and one-third of the number, 5,500, were hired in 1984. Especially the number of female high school graduates decreased to half of what it was two years ago. The same phenomenon is observed at insurance companies (Figure 3). Upon survey of 300 large-scale enterprises, the ratio of manpower conservation due to the importation of office automation instruments was 6.5% a year at the average (Japan Institute of Office Automation).

While companies do not discharge employees as they import office automation instruments, it is unavoidable for them to decrease the number of new employees. This has made some of the new graduates take jobs which were considered to be irrelevant to them. In general the number of workers who are science major university graduates has increased, and those workers who are university graduates and majored in other than science, and female high school graduates tend to decrease at factories. Male workers are preferred to female workers, and young ones tend to be more appreciated. While the number of employed engineers is increasing, skilled workers are decreasing, and unskilled workers are tending to increase (Ministry of Labor, Statistics and Information Department).

According to a questionnaire on enterprises conducted by the Economic Planning Agency, Planning Bureau, 39.0% responded that they would increase the number of employees five years hence, a number greater than the 26.4% who said they would decrease the number. However, at managerial department and production levels, it is clear that the proportion of companies predicting a decrease in the number of employees exceeds the proportion of those predicting an increase as Figure 4 shows.

Figure 3. Number of New Employees



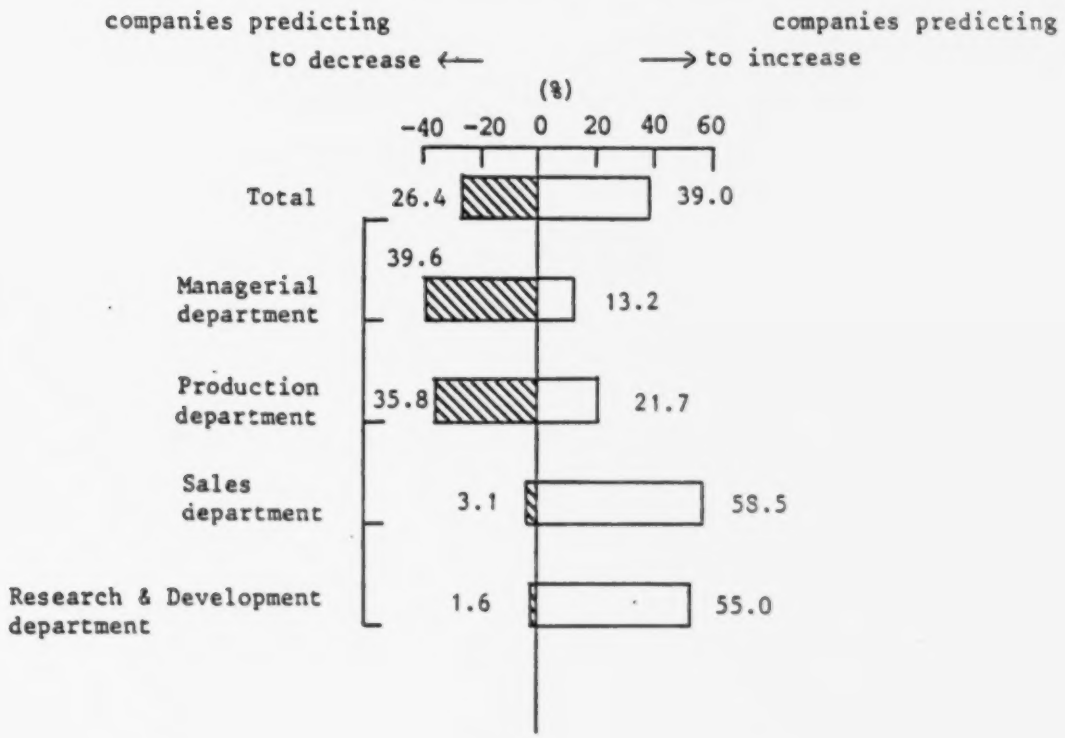

Source : Nihon Keizai Shinbun, July 2, 1984

It is presumed from today's trend that there will be 510,000 excess clerical workers, 1,770,000 excess skilled workers, and 1,270,000 workers in the agricultural, forestry and fishing industries respectively in the year 2000 as Table 2 shows. However, demand exceeds supply by 1,270,000 in sales, 320,000 in service, 190,000 in transportation and 60,000 in communication, and other job areas which need specialists. The unemployment rate is expected to rise due to the unbalance of demand and supply in the labor market and to the increase of aged workers who cannot be easily reassigned (Economic Planning Agency, Planning Bureau).

Users evaluated the influence of the importation of robots on labor positively, as Table 3 shows. Some workers value painting or welding as a job done by "experts", although these jobs now can be accomplished by robots. The idea that labor is a necessary evil in order to earn wages is not easy for Japanese people to accept. If they think that robots take uneasy tasks for them so that they can take jobs more suitable for human beings, there will be less reluctant feelings for the importation of robots. It is possible that even if robots lessen labor force requirements, they only would shorten the work time for workers, thus allowing them more free time without raising the unemployment rate.

However, as the influence of importation of microelectronic technology spreads throughout the economy or when there comes a slowdown in the Japanese economy, problems such as the decreasing demand for labor and the reassignment of middle-aged and aged workers, who cannot easily readjust themselves to new tasks, are sure to rise.

Figure 4. Number of Employees in Five Years Hence




Source : Economic Planning Agency, Planning Bureau,
Research on the Labor Market System in Future, 1984

Table 2. Demand and Supply of Labor Force in 2000

(unit: million)

| Classification of workers | 1980 | | 2000 Demand | | 2000 Supply | |
|---|---|---|---|---|---|---|
| | | % | | % | ( * ) | % |
| Professional & technical | ( 5.04) | 9.1 | ( 8.38) | 13.2 | (-0.06) | 13.1 |
| Administrative & managerial | ( 2.70) | 4.9 | ( 3.88) | 6.1 | (-2.03) | 2.9 |
| Clerical | ( 9.60) | 17.3 | (13.41) | 21.2 | ( 0.51) | 22.0 |
| Sales | ( 7.85) | 14.1 | ( 9.77) | 15.4 | (-1.27) | 13.4 |
| Agricultural,Fishing and Forestry | ( 6.00) | 10.8 | ( 3.04) | 4.8 | ( 1.27) | 6.8 |
| Mining & Quarrying | ( 0.07) | 0.1 | ( 0.03) | 0.0 | ( 0.06) | 0.1 |
| Transportion & Communication | ( 2.41) | 4.3 | ( 2.14) | 3.4 | (-0.19) | 3.1 |
| Skilled & production process | (17.21) | 30.9 | (16.93) | 26.8 | ( 1.77) | 29.6 |
| Security | ( 0.77) | 1.4 | ( 0.96) | 1.5 | ( 0.25) | 1.9 |
| Services | ( 3.89) | 7.0 | ( 4.41) | 7.0 | (-0.32) | 6.5 |
| Others | ( 0.12) | 0.0 | ( 0.35) | 1.0 | (-0.25) | 0.6 |
| Total | (55.66) | 100.0 | (63.29) | 100.0 | | 100.0 |

* the difference between demand and supply

Source: Economic Planning Agency, Planning Bureau, Research on the Labor Market System in Future, 1984

Table 3. Merits and Demerits of Importation of Robots
(Evaluation by Users)

| | Merits | Demerits |
|---|---|---|
| Working condition | Improvement of safety *** | |
| | Decrease of exhaustion and stress *** | |
| | Decrease of working overtime ** | |
| Labor force | Relief from the lack of manpower *** | Increase of excess workers * |
| | Increase of tasks for aged workers, etc. * | |
| | Decrease of new employee ** | |
| Work | Improvement of skills *** | Increase of necessity for reeducation *** |
| | Increase of work requiring skills and knowledge ** | Increase of workers unable to adjust themselves to new tasks * |
| | Increase of chances to acquire skills ** | |
| | Increase of skilled occupation * | |
| | Decrease of monotonous operation | |
| Labor-management relations and morale | Improvement of morale ** | |
| | Improvement of communication among workers * | |

Increase of necessity to keep good labor-management relationship is
***: very remarkable.
**: remarkable.
*: noticeable.

Source: Ministry of International Trade and Industry, Committee for Research on the Trend of Robot Industry, Impacts of Diffusion of Robots on Labor, 1984

5. Workers' Attitudes to Introduction of Microelectronics Equipment

According to a survey of 277 companies conducted by the Japanese Federation of Electrical Machine Workers Unions (members: 570,000), Policy Department, 92.7% of the companies have imported microelectronics equipment. An average of 67 pieces of equipment per company have been imported, and that is one piece of equipment per 20 workers. At one third of the companies, 50% or so of the production process has been automated. In general the importation of microelectronics equipment caused the companies to increase the number of workers, but it is presumed by most companies that the number of new employees will decrease as it becomes harder to absorb all the excess workers by reassignment in the future. Upon various surveys it is assumed that the introduction of microelectronics equipment has decreased employment 13.5% so far.

The reaction of the members of the union assumed by branch leaders is as follows: Importation of microelectronics equipment should be propelled for the growth of the enterprise, 19.5%; it is necessary to take problems of employment, safety and education into consideration before automatization, 67.9%; and not interested in the issue, 4.0%. According to the survey conducted on each individual member by the labor union of Matsushita Electric Company, only 17-18% are worried or a little worried about the importation of microelectronics equipment. Also few workers, namely 1.4% of clerical workers, 0.4% of engineers and 6.7% of technicians objected to the importation, based upon a survey conducted by the Institute of Asian Social Affairs. One of the reasons that workers do not necessarily object to having their jobs taken by robots and being reassigned is because job rotation is quite common in Japan.

As for safety, consideration for mental health and devices to cope with noise are pointed out to be necessary. More workers are concerned for the problem of eyestrain caused by VDT (video display equipment). This issue has become a subject discussed by labor and management (General Council of Trade Unions of Japan, Committee for Research on

Microcomputer, Japanese Federation of Electrical Machine Workers Unions). In the first agreement on the problem of robots concluded in 1983 at Nissan Motor Company it is stipulated that there would be no unprofitable changes in working conditions because of the importation of robots.

About half of the companies had discussions with employees or the union before the importation of microelectronics equipment. The issues that concerned workers included reassignment, education and training (63.8%), safety (40.9%), and working hours (30.7%) (Ministry of Labor, Statistics and Information Department).

## III. REASSIGNMENT AND RETRAINING

### 1. Reassignment

Under the Japaneses system of lifelong employment, job reassignment has been an important means to educate and train workers. But as Table 4 shows, the number of enterprises which point to the introduction of microelectronics equipment as the reason to conduct reassignment is increasing.

Table 5 is the tabulated results of a questionnaire on employment adjustment caused by the introduction of microelectronics equipment. Most enterprises facing labor problems arising from the introduction of microelectronics equipment solve them by in-house reassignment of workers.

According to a survey conducted by the National Institute of Employment and Vocational Research (1982) on 6,476 enterprises in the whole industry, 40.7% of the enterprisees which automated the process with microelectronics equipment reassigned workers. To be precise, reassignment from the workplace where microelectronics equipment is installed into others, from another workplaceinto where microelectronics equipment is imported, and in both the ways are 27.5%, 6.4%, and 6.8% respectively. The proportion of the workers who were reassigned from the workplace where automation occurred to other places (number of

Table 4. Reasons for Reassignment

%

| Reasons | Inter factory | | Intra factory | |
|---|---|---|---|---|
| | * | ** | * | ** |
| Integration or abolishment of work place | 11.0 | 13.4 | 10.5 | 11.8 |
| Expansion or establishment of new working place | 36.3 | 32.2 | 22.2 | 21.3 |
| Production adjustment | 32.4 | 32.3 | 40.0 | 40.6 |
| Adjustment of organization | 7.9 | 10.6 | 9.4 | 11.8 |
| Simplification of organization | 14.8 | 18.5 | 20.2 | 22.8 |
| Change of products | 17.5 | 20.1 | 17.5 | 19.1 |
| Automatization | 10.5 | 17.3 | 17.7 | 26.3 |
| Education of workers | 56.1 | 62.5 | 56.8 | 61.7 |
| Others | 16.4 | 13.6 | 13.9 | 10.7 |

*: reassigned in 1980
**: will reassign in a few years hence

Source: National Institute of Employment and Vocational Training, Research on Effective Uses of Workforce in Enterprises, 1982

Table 5. Scale and Proportion of Company Which Carried Out Personnel Reassignment (ME equipment introduced)

Unit: %

| Scale of company | Total | Carried out (M.A.) | | | | | | | | | Hardly done reassignment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total | Reassigned to another job in the same working place | | | Reassigned to another working place in the same company | | | Transferred to a related company | Dischange or voluntary resignation | |
| | | | Total | Department to which workers were reassigned | | Total | Department to which workers were reassigned | | | | |
| | | | | Production | Clerical & sales | | Production | Clerical & sales | | | |
| Total | 100.0 | 29.5 | 28.0(100.0) | (97.7) | (10.6) | 3.3(100.0) | (92.0) | (43.3) | 1.2 | 0.4 | 70.4 |
| 1,000 or more | 100.0 | 44.8 | 43.0(100.0) | (98.8) | (14.6) | 6.1(100.0) | (97.3) | (51.4) | 3.1 | - | 55.0 |
| 300 to 999 | 100.0 | 33.0 | 32.0(100.0) | (97.5) | (12.8) | 3.6(100.0) | (93.3) | (52.0) | 1.7 | 0.2 | 67.0 |
| 100 to 299 | 100.0 | 25.8 | 24.2(100.0) | (97.5) | ( 8.2) | 2.8(100.0) | (89.7) | (35.7) | 0.7 | 0.6 | 74.1 |

Source: Ministry of Labor, Statistics and Information Department, Survey on Technological Innovation and Labor, 1983

workers reassigned / number of workers in the workplace before automation) is 17.9% at the median. The percentage of workers reassigned to other work places to take almost the same tasks was 30.6%. While 58.0% were assigned other kinds of tasks where they can utilize what they have experienced, 11.4% cannot make use of their knowledge and skills. Maladjustment of workers who are reassigned to a new work placd would be a problem. Many enterprises mention increase of work as a reason not to reassign workers, and some others replied they did not because they did not intend to. 12.0% did not reassign employees for various reasons although automation caused excess workers.

2. Changes of Tasks

The Japanese Federation of Electrical Machine Workers Unions, Research Department has conducted research on its 2,000 members to find about changes of tasks. The following is the general tendency according to the survey:

(1) Monotonous work is increasing especially at assembly lines.

(2) Guard duty has increased.

(3) Working conditions have been improved in terms of safety. Especially 60% of workers who deal with the machinery processing replied positively.

(4) More responsibility is placed and more authority is given at work. It is because the relationship of processes becomes tighter and the influence that they give to one another increases as automation advances.

(5) Cooperation of workers becomes more important. Especially at assembly lines this has become evident because:

a) Work done at a certain process influences others a great deal, and thus it is necessary to contact each other;

b) Automation has just begun and not everything is settled down; and

c) It became necessary to keep contact with people in the maintenance department.

(6) Workers have to become "multi-skilled". The number of machines and equipment has increased in all the departments, and they expand and complicate worker tasks.

(7) Tasks of quality control and maintenance of machinery are increased. Workers at production lines have to deal with maintenance of equipment and machines too.

According to a survey conducted by the Japan Society for the Promotion of Mechanical Industry, the Economic Research Institute, the enterprises which replied that sphere of worker duties expanded outnumbered those which replied it did not. This tendency is evident, especially among large-scale enterprises (pp. 118-119).

Upon research conducted on 4,100 enterprises in manufacturing industry, the following are mentioned as reasons for developing multi-skilled labor force (multiple answers): (1) to improve productivity (89.2%), (2) to develop personnel (57.9%), (3) to promote morale (55.8%), and (4) to develop ability to adjust to new technology (53.7%). Also, many of the technicians themselves welcomed the idea of becoming multi-skilled. In order to maintain the ability to adjust to changes and skills supported by instinct and a knack, it is necessary to educate workers to be technicians with a broad range of skills and knowledge. (The Research and Development Institute of Vocational Training, 1983, 1984b).

### 3. Changes of Necessary Knowledge and Skills

Automation caused changes in the requirements of work. According to a survey conducted by the Ministry of Labor, Statistics and Information Department, required skills were changed at 67.5% of the processes where microelectronic equipment has been introduced to the line. In these cases new skills adding to the existing ones became necessary (63.1%), higher levels of skills become necessary (24.2%), existing skills become unnecessary and new ones are required (15.1%) and only lower levels of skills become necessary (14.2%).

The results of a survey conducted by the Japanese Federation of Electrical Machine Workers Unions, Research Department, are concluded as follows:

(1) Knowledge of computer manipulation and programming and knowledge of electronics and machinery became necessary. This corresponds to the fact that education about the theory of machinery and electronics are regarded as very important. Also accuracy and ability to acquire new skills and knowledge are required.

(2) At processing lines, skills acquired through experience are still necessary for example in informing tasks to play-back robots, yet these skills are also expected to be modified.

(3) At assembly lines, knowledge of electronics is more necessary and specific skills are less necessary than at processing lines. The period necessary to train workers to be experts is shortened, and the operation of the system has been simplified.

According to the response to questionnaires, although workers who manipulate automatic machinery are expected to have a wide range of knowledge so far, it seems that it is because microelectronic equipment has just begun to be imported and is causing troubles, and those workers assigned to these places are capable ones who are expectead to be leaders to support automation in the future.

A survey conducted on small- and medium-scale enterprises reports that what has become more important in the past ten years are the

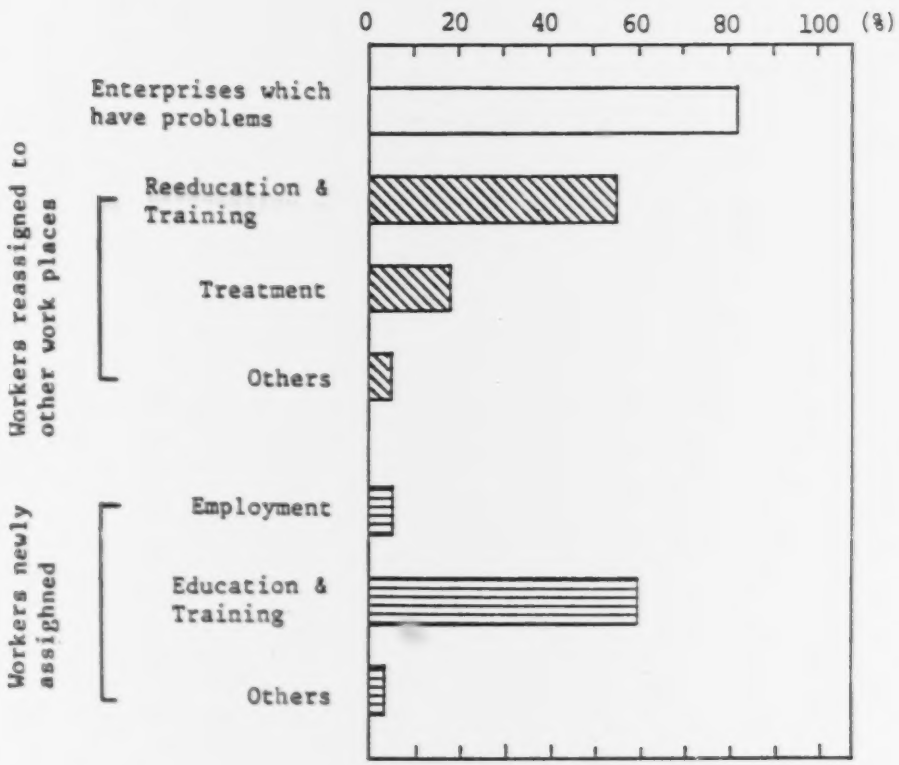
abilities to evaluate and measure products, to make plans, and to solve problems, etc. (The Research and Development Institute of Vocational Training, 1984a). The ability and knowledge which became more important at factories introducing microelectronic equipment for automation than at factories which have not are the ability to develop programs, to diagnose the condition of machinery and equipment, to mend them, to find and solve problems and to make plans, and knowledge of automatic-control sequence, of quality control, and of processes before and after one's own process, etc. Skills supported by instinct and a knack are regarded necessary at factories with and without automation facilities.

### 4. Introduction of Microelectronic Technology and Technical Education

To the questions, "Are there any problems among workers who have been reassigned to other workplaces due to introduction of robots?" and "Are there any problems among workers who have been assigned to the production process after the introduction of robots?", 70% of the enterprises which own robots answered "yes" to the former and 60% answered "yes" to the latter. Fifty-five percent of the enterprises which replied positively to the former mentioned the problem of reeducation and training, and 59% of those which replied positively to the latter mentioned the problem of training and education. The problem of education and training is the main issue (Figure 5) (Ministry of Labor, 1983, pp. 120-121). Figure 6 shows the case of Office Automation, and it is apparent that education and training are main points.

OFF-JT (off the job training), education and training of workers who were assigned to the process after the introduction of robots, occurred at 60.0% of enterprises. Programs are offered by the manufacturer of robots and selling agents as well as by the enterprises who own robots. Most of the enterprises who did not offer OFF-JT trained workers in terms of OJT (on the job training) (Ministry of Labor, Statistics and Information Department).

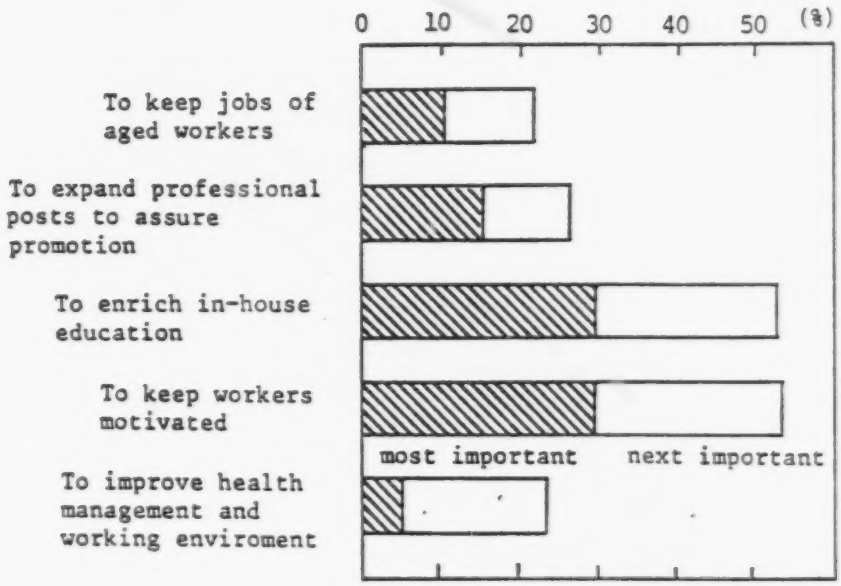
Figure 5. Problems Caused by Importation of Industrial Robots




(Total is over 100 due to multiple answers)

Source : Ministry of Labor, Supplementary Survey of Research on Labor Productivity in 1981

Figure 6. Importation of Office Automation Instruments and Administrative Problems




(Total is over 100 due to multiple answers)

Source : Ministry of Labor, Survey on Work Force in 1981

The way to conduct training for microelectronic introduction depends upon each enterprise; however, the majority train workers in terms of OJT. In order to adopt new technology a general knowledge of machinery, electricity and electronics is regarded as necessary, and the education has been done in the form of workshops and others. Education and training are done as follows:

(1) Fundamental Education. Factories stress the fundamental education of electronic technology as in-house fundamental education. Some enterprises offer one year of fulltime courses for new high school recruits and workers in skill development courses at in-house training facilities or have them trained at vocational schools.

(2) Expansion of OJT. OJT, which used to be done at the workplace, has expanded after the importation of microelectronic technology. These days not only chiefs of the workplace but also their subordinates such as group leaders and machine keepers teach and train workers. The education is given by staff in the department of research and development too.

(3) Rotation and Loan of Workers. At many workplaces, workers have been rotated to save labor, to make workers acquire different kinds of skills, or to adjust production. Nowadays rotation plays an important role as a form of education to develop personnel and to activate the workplace. For example, workers are reassigned sometimes from the shop floor to the planning and development department for a definite term.

(4) Promotion and Education. Education and training are expected to raise the level of workers in general, but it is deeply related to promotion also. Traditionally, it has been common that a worker is recommended by his boss to take courses and be promoted to chief; however, now selective education is becoming more available for production workers.

According to research conducted by the National Institute of Employment and Vocational Research (1983b, pp. 24-28), the following procedure is commonly followed in introducing numerically-controlled

machinery. First a few workers on the shop floor are chosen and sent to the manufacturer to be educated before the installation of the machine, and trained in terms of OJT when the machine is installed, to be "core-workers". Then these "core-workers" teach and train their colleagues.

At the level of engineers, professional knowledge and skills have changed drastically, and the majority of engineers in production development, software designing and data processing departments feel that most of their knowledge and skills have been acquired in the last five years (Figure 7). Continual ability development is thus crucial, and in-house OJT is regarded effective in general. However, it is essential to be offered a good job and good teachers. A research study reports that the more a worker is rotated, the more his knowledge is deepened and his skills are developed. It seems to be related to the fact that peripheral knowledge is important in skill acquisition, research study and practice of technological tasks at enterprises. Although it is preferable to respect the spontaneity of engineers, systematized ability development is said to be necessary because of the speed of innovation (National Institute of Employment and Vocational Research, 1983a).

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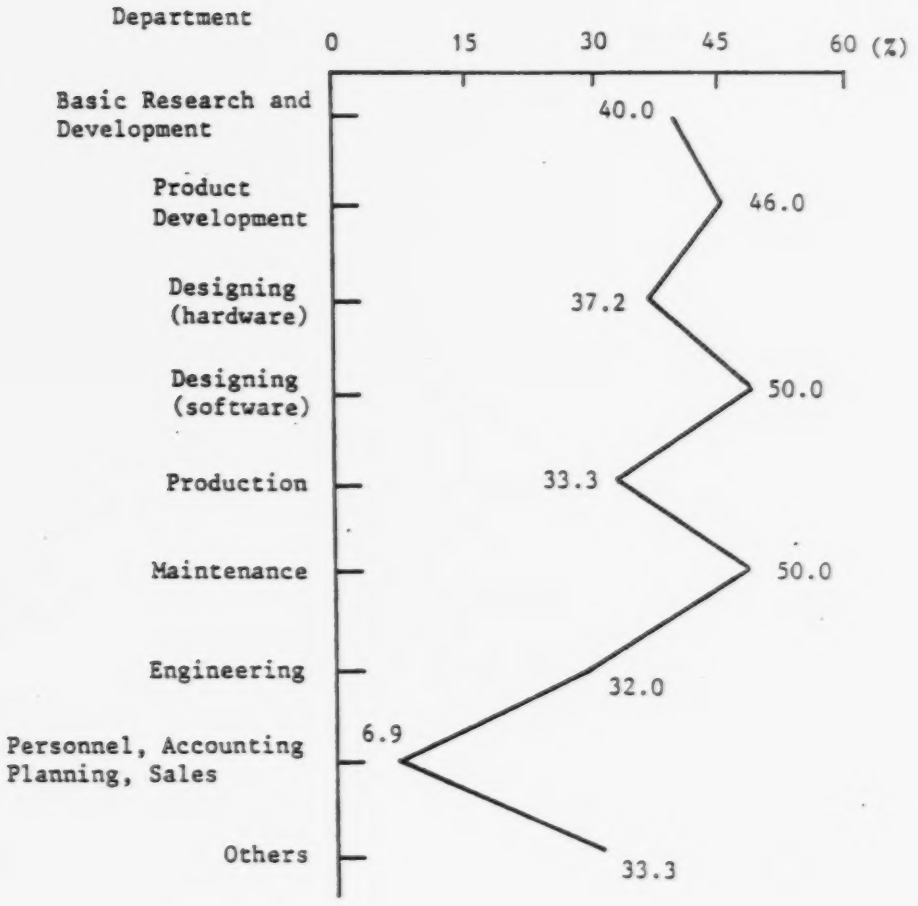
Figure 7. Ratio of Skills and Knowledge Acquired in the Last Five Years




Source : National Institute of Employment and Vocational Research, Research Report on Changes of Tasks at Workplace with Technological Innovations, 1983

speed of innovation (National Institute of Employment and Vocational Research, 1983a).

### 5. Trend of In-House Education

Although skilled workers are regarded as important even after the introduction of robots in Japan, microelectronic-based technological innovations tend to create production systems which can be manipulated by semi-skilled or unskilled workers. It is possible to replace skilled workers with unskilled part-time workers, yet thoughtless treatment of the former may lower factory adaptability to technological innovation.

While large enterprises can afford to develop necessary personnel in themselves, small- and medium-scale enterprises cannot and have to depend on workers who have gained work experiences at other enterprises. This will impede accumulative development of skills at small- and medium-scale enterprises and increase the demand for graduates at well-equipped public training institutes.

National Institute of Employment and Vocational Research carried out a survey of work places where microelectronic equipment has been introduced, and reported the following points (1983b, pp. 4-5).

(1) Programs being simplified, even skilled workers of the old type can adapt well to numerically-controlled machinery. The field of extra, super, precise processing, which cannot be done by machines, remains and skills are the prerequisite for operation of the best programs. Thus it is necessary to maintain skilled workers of the old type.

(2) If engineers develop programs which demand workers on the shop floor to deal with monotonous machinery operation, worker morale will be destroyed. It is necessary to create a system which lets workers themselves develop programs.

(3) Some skilled workers request reassignment to different workplaces or stick to old machines, saying they cannot abandon their old skills, which took them a long time to develop, in order to acquire

new knowledge and skills; there are also skilled workers who adapt to highly automated machines and play active roles. Educational and training programs to develop skills, utilizing the old skills as much as possible, are necessary.

A survey conducted by the Japan Society for the Promotion of Mechanical Industry, the Economic Research Institute, reports the difficulty of retraining middle-aged and aged workers. At less than 40% of enterprises, the proportion of middle-aged and aged workers who efficiently carried out their new tasks was over 50% (pp. 125-129). Yet those who are hard workers, or who are motivated and eager to learn, have adapted well to new technology despite their ages. 71.0% of the enterprises regard that middle-aged or aged workers can work effectively if they are provided with suitable education (pp. 172-173).

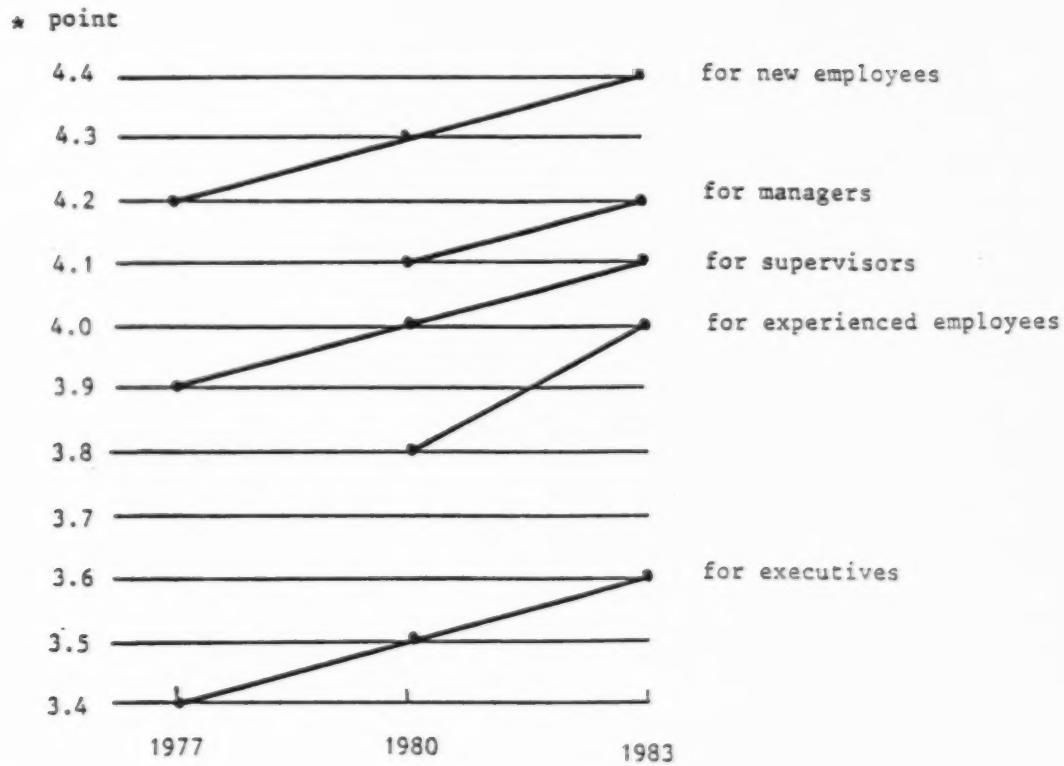
Based on a survey conducted by the Japan Recruit Center, in-house education and training programs tend to be considered important at any rank as Figure 8 shows. The aim of the programs is to train new employees to be capable workers, to enrich the skills of experienced workers, to develop the leadership and problem solving abilities of supervisors, and to broaden the view of managerial staffs. Also, most of the enterprises support workers in their self-education. Introduction of seminars and workshops outside the companies, support for taking distant education, and support for obtaining qualifications are common.

According to Hitachi Research Institute, 83% of management and 66% of labor think that the system of regular recruitment of new high school or university graduates, which is the first step of the lifetime employment system, will not be changed. The system of regular recruitment of new graduates has supported a low unemployment rate for youths and thus has played an important role in the maintenance of social order. As Table 6 shows, the majority think that in-house education and training will be more common and enriched. Workers are motivated to develop themselves and to participate. 90% of them are

willing to take in-house programs of training and education even if they are hard.

In order to cope with various changes in the demand for labor, it is necessary to activate systems of education and training not only for the labor market inside the enterprise, but also for the outside labor market. Special training schools, vocational schools, information systems and other devices have to be organized to educate people who can meet various needs of society.

Figure 8. Importance of Education and Training




★ : the average of 5: very important
4: important
3: somewhat important
2: a little important
1: little important

Source : Japan Recruit Center, Survey on Education and Training in Enterprises, 1983

Table 6. The Condition of In-House Education in 1990

%

| | emphasized | emphasized to some extent | no change | regarded less important |
|---|---|---|---|---|
| Management | - | 69.4 | 29.8 | - |
| Labor | 0.8 | 61.3 | 31.5 | 4.8 |
| Neutral | - | 51.3 | 43.8 | - |
| Total | 0.3 | 61.3 | 33.8 | 1.8 |

(Delphi survey)

Source: Hitachi Research Institute, Future of Japanese Labor-Management Relationship, 1983

## IV. IMPACTS OF HIGH TECHNOLOGY ON EDUCATION

### 1. Educational Uses of Computers

Computers can be seen at home. In big Japanese cities 14.6% of lower secondary school boys and 10.4% of upper secondary school boys owned microcomputers at home in 1984. Although the school is one of the major fields left behind by technological innovation, it is still influenced by the diffusion of computers.

Table 7 shows percentages of institutions which own microcomputers. Even at upper secondary schools, only 56.4% own microcomputers. Among the schools which have more than one computer, the average number of computers is 4.20; 36.3% of schools own one computer, 63.9% of schools own up to 3 computers; 76.6% of schools own up to 5 computers; and only 1.7% of schools own more than 21 computers. The major reason why the upper secondary schools own more computers is that computer education is offered in vocational courses, and upper secondary schools have the advantage of funding based on Vocational Education Promotion Law and the Law for the Promotion of Science Education.

Table 8 shows the proportion of the teachers who use microcomputers. Partly because the number of computers per school is small, only 10% of the teachers use them once a week or more. Male teachers approach computers more than female teachers do, and their ages do not matter so much. Table 9 shows the fields where computers are employed. They are mainly used in the form of programming at lower and upper secondary schools. At elementary schools, they are used in the

Table 7. Possession of Microcomputers at Schools

(as of May 1, 1983)

| Classification | * | ** | *** |
|---|---|---|---|
| Kindergarten | 0.32% | 1.00 | 0.00 |
| Elementary school | 0.58 | 1.78 | 0.01 |
| Lower secondary school | 3.09 | 1.37 | 0.04 |
| Upper secondary school | 56.38 | 4.20 | 2.36 |
| Citizen's public hall | 0.84 | 1.86 | 0.01 |
| Prefectural library | 2.94 | 1.50 | 0.04 |
| Municipal library | 4.07 | 1.00 | 0.04 |
| Museum | 6.66 | 2.94 | 0.19 |

*: Rate of possession
**: Average number of computers among schools equipped
***: Average number of computers among all the schools

Source: Ministry of Education, Science and Culture, Social Education Bureau, Survey on Audio-Visual Equipments at Educational Institutions, 1984

Table 8. How Often Microcomputers Are Used in Schools

(as of May 1, 1983)

| | | never | a couple of times a year | a couple of times a month | once a week | twice a week |
|---|---|---|---|---|---|---|
| Elementary school | * | 83.07% | 6.15% | 3.07% | 1.53% | 6.15% |
| | ** | 99.21 | 0.37 | 0.19 | 0.07 | 0.13 |
| Lower secondary school | * | 65.60 | 13.60 | 10.40 | 5.60 | 4.80 |
| | ** | 96.67 | 1.46 | 1.07 | 0.39 | 0.39 |
| Upper secondary school | * | 72.67 | 10.07 | 6.49 | 3.58 | 7.17 |
| | ** | 83.07 | 6.60 | 4.10 | 2.07 | 4.14 |
| Sex Male | | 69.78 | 10.88 | 7.42 | 4.05 | 7.84 |
| Female | | 89.56 | 5.49 | 2.74 | 1.09 | 1.09 |
| Age 20's | | 70.72 | 14.47 | 6.57 | 1.64 | 6.57 |
| 30's | | 70.16 | 8.87 | 10.68 | 4.23 | 6.04 |
| 40's | | 73.73 | 9.34 | 4.04 | 4.79 | 8.08 |
| 50's | | 78.69 | 8.28 | 2.36 | 2.95 | 7.69 |

*: Teachers whose school own computers
**: All teachers

Source: Ministry of Education, Science and Culture, Social Education Bureau, Survey on Audio-Visual Equipments at Educational Institutions, 1984

Table 9. Educational Uses of Microcomputers in Schools

(as of January 1, 1983)

| School level | | CAI | CMI | Computer education | Club activities | * | ** |
|---|---|---|---|---|---|---|---|
| Elementary schools | + | 25 | 14 | 0 | 17 | 36 | 24,970 |
| | % | (69.4) | (38.9) | (0.0) | (47.2) | | |
| Lower secondary schools | + | 49 | 136 | 4 | 63 | 194 | 10,802 |
| | % | (25.3) | (70.1) | (2.1) | (32.5) | | |
| Upper secondary schools | + | 819 | 1,503 | 377 | 877 | 2,370 | 5,196 |
| | % | (34.6) | (63.4) | (15.9) | (37.0) | | |

+: Number of schools
*: Number of schools having microcomputers
**: Total number of schools (as of May 1, 1982)

Source: Ministry of Education, Science and Culture, Social Education Bureau, Survey on Educational Uses of Micricomputers, 1983

form of computer-assisted instruction or in club activities in general; but each pupil rarely approaches a computer because the number of computers per pupil is small, and teachers generally use them for demonstration (Ministry of Education, Science and Culture, Social Education Bureau, 1983, 1984). However, computers are being acquired at a high speed. During the four months when the surveys were conducted (Jan. 1, 1983 and May 1, 1983), the ratio of schools owning microcomputers rose 6.6%, 2.2%, and 0.5% at upper secondary schools, lower secondary schools and elementary schools, respectively.

Thus, although not very many schools have computers at this point, most of the teachers consider that computers are useful in education. Since the proportion of teachers who agree with the introduction of computers is large, as Table 10 shows, they will continue to be acquired. The degree of diffusion will be determined by the following points:

(1) Well-designed training programs are offered for teachers at local educational centers and others to make them familiar with computers.

A standard curriculum is being developed by the Ministry of Education.

(2) Well-designed educational software is developed. In order to make good programs, research activities are systematized; distributive machinery of information is organized; and supporting programs to help teachers who do not know about computers are developed.

(3) A sufficient amount of quality educational information is prepared. Data bases which provide information about subject areas, teaching materials, educational research, and social education are developed. The data base of social education has information about study centers, teachers and equiupment, for example. Systems which enable the users to select and get information according to their wishes are provided.

Table 10. Teachers' Opinion of Educational Uses of Computers

| | Elementary schools | Lower secondary schools | Upper secondary schools |
|---|---|---|---|
| Use of computer is an effective method of instruction. | 63.8% | 69.4% | 74.1% |
| The computer is effective in educational data processing. | 78.8 | 86.8 | 86.8 |
| Computer education is necessary. | 70.8 | 75.1 | 81.7 |
| Development of software is important. | 79.2 | 83.5 | 84.8 |

Source: Ministry of Education, Science and Culture, Social Education Bureau, Survey on Audio-Visual Equipments at Educational Institutions, 1984

Computers can both offer the same information to all, and develop each individual's ability by the use which suits his characteristics. Computers can be used to conduct a centralized, uniform education, or to provide a diverse education appropriate to the ability of each individual and able to expand the differences in ability as a result.

## 2. New Media and Their Educational Uses

Different kinds of new media have been put to practical use in Japan. Information Network Systems (INS), which link users by means of optical fiber cables, are being developed and should be accomplished on a nation wide scale in the year 2000 (Nippon Telegraph and Telephone Public Corporation). Varieties of data bases being prepared along with INS help to establish and enrich the information infrastructure. By the use of information the distance of time is overcome, and the amount of data is increased and information becomes more accurate. Information itself becomes more important and widely used as a necessity in society (Economic Planning Agency, Economic Welfare Bureau, 1983).

The experiment of videotex, which is called the CAPTEN (Character and Pattern Telephone Access Information Network) system in Japan, began in 1979, and commercial services started in 1984. Two-way CATV is expected to contribute to the improvement of regional service by providing cultural programs and others. CAI packages using videodiscs have been developed into marketable products and sold mainly to homes and tutoring schools.

Satellite communication is expected to expand the capacity of broadcasting educational programs on a national scale in order to improve education in remote rural areas and contribute to equal educational opportunities. Also it is expected that teletext, high-definition TV, still pictures broadcasting etc. will be used in schools in the future (Ministry of Posts and Telecommunications, Radio Regulatory Bureau, 1982).

Current plans anticipate an educational information network using those new media to link schools, institutions for social education and

home. A scheme to select a model city and construct such "Teletopia" has been carried forward (Ministry of Posts and Telecommunications, Radio Regulatory Bureau, 1984).

At tutoring schools, facsimiles and other equipment have been introduced, and education at a distance is being provided to students who study at home.

However, although those educational uses of new media are studied and planned by the people who intend to offer education through these media, there is a little social need for it at the moment. Diffusion of new media in education will not be realized rapidly (Hirota).

### 3. Fundamental Scholastic Aptitude and Vocational Education

Microelectronic technology influences education not only in the sense that computers and robots are introduced to schools, but also by the fact that microelectronic technology brings about changes in society, which leads to changes in the o jectives and contents of education.

What is expected to be in the school curriculum under such circumstances previously described? Although the speed that knowledge and skills are out-dated will increase more rapidly from now on, formal schools cannot cope with those changes because they are not flexible. Thus fundamental education which develops an ability to cope with the changes of knowledge and skills is expected to be provided at schools. A variety of knowledge and skills needed in work are supposed to be obtained after formal education at vocational schools or through work itself. This tendency will be more remarkable as a result of the Japanese life-long employment system. As university and college education becomes popular, it becomes general. Education at graduate schools or at in-house institutions will become more important (Economic Council, Long-Term Outlook Committee, 1983a).

NHK conducted a survey to find out what parents expect their children to acquire at lower secondary school (1977). The percentage of the total number of parents who consider "fundamental scholastic

ability" as the most or the second most important was 63%. In the same way "ability in decisionmaking" was 33%, and "manners and social morality" was 32%. According to a survey carried on by the Prime Minister's office, 42% of fathers and 39% of mothers consider moral education is the most important, and 31% of fathers and 35% of mothers consider basic subjects such as Japanese and mathematics are the next most important subjects (1982).

Then what is the fundamental scholastic ability in this changing society? Is what are called the three R's the only necessary matters? Is it possible to develop children's adaptability just by giving them an equal general education?

The necessity of new kinds of literacy has been mentioned. Some people assert computer literacy, which is the ability to communicate with computers, and information literacy, or the ability to utilize information, are necessary. Abilities to communicate through media, for example, abilities to understand media, to select and utilize media, and to set up media; in other words media literacy is also said to be important (Sakamoto). These new ideas of literacy have been brought forth as fundamental abilities. Yet there is no general agreement on the problem of curriculum design.

Does not vocational education have to be provided as a part of a general education? The Japanese educational system has played the role of a screening device selecting students to go on to the working world, rather than helping students prepare for work. Japan has nothing like the apprenticeships provided in Europe, and most Japanese young people do not possess any actual professional skills when they are hired by enterprises. One of the reasons that the number of young people who change their jobs is increasing is that there is no specific vocational orientation.

Vocational education is offered along with general education at the level of upper secondary schools, and the proportion of students in vocational programs was 28.6% in 1984. However, there is a tendency to consider that the general program is a preparatory program for students

whose grades are good and who plan to continue to study at universities, and that the vocational program is for students whose grades are poor. Enterprises appreciate general scholastic ability and adaptability more than skills and knowledge in a specific job area because they consider the latter can be provided by in-house education and training if students possess adequate scholastic attainment.

According to a survey conducted by the Ministry of Education, Science and Culture, Elementary and Secondary Education Bureau, most of the enterprises in the secondary industry which prefer graduates of general courses to graduates of technical courses consider that the former can adapt themselves to various kinds of jobs after they are given in-house education and training. Of course there are many small- or medium-sized enterprises which cannot offer complete in-house education and want to hire graduates of technical courses because of their special skills and knowledge in the job area (1983).

Even in this case, however, special knowledge and skills are considered to be general knowledge and skills which are someowhat modified. Although courses in electronic technology and information technology are being newly established at the upper secondary school level, the necessity of developing adaptability and creativity in students is much more stressed because of the speed with which skills and knowledge become out-dated.

The Science and Vocational Education Council, which discussed vocational education at upper secondary school in the future, reported it is necessary to prepare new courses such as information process and electronic communication to cope with technological innovation and social demand. At the same time, however, they stressed that students should possess basic knowledge and skills of wide application, instead of special knowledge which can easily be out-dated, so that they can cultivate their creativity and ability to solve problems. Also it is suggested that cooperative relationships should be developed among schools and training centers in order to make vocational programs open and flexible (1984).

## 4. Proposals of Educational Reform

On September 5, 1984, the newly established Ad Hoc Council on Education under the direct jurisdiction of the Prime Minister, held the first general assembly. The report that it will submit in three years will exert a great influence on the trend of education in Japan. Many people today are not satisfied with the present condition of education and are very interested in the problem and the political intentions of the government.

Several political groups have made proposals also (Subcommittee on contents of Education and Other Related Matters of Central Council for Education, The Conference on Culture and Education, Japan Committee for Economic Development-1984a, 1984b-, The Kansai Committee for Economic Development, Kansai Economic Federation, Kyoto Colloquium on Global Change, etc.). Although the proposals are all unique, they have many points in common as well. In general they appreciate the fact that the educational system of Japan has brought technological innovation and today's stable economic growth, but point out that the educational system has to be changed because Japan has become an information society which keeps changing, consequently placing demands on people's adaptability and creativity which were previously disregarded. The following lists the major points in the proposals.

### (1) Uniformity

The Japanese educational system changed from a diversified system to a uniform system after World War II because the former had some shortcomings. Currently, uniformity of the content of education is considered favorably, hence the same kind of education is being provided everyone regardless of ability and aptitude, in part because of excessive egalitarianism.

For instance even if a student scores a good mark in a subject on an entrance examination, he is to be judged only by the total marks on all the subjects in the examination; the fact that he is superior in a

certain subject would not be appreciated. Thus there is an opinion that education has to be diversified to meet various needs of society and to help people with different ability and aptitude. A counterargument is that diversification only brings discrimination in a society of uniform value standards.

(2) The ordeal of examination

Competition is keen because all universities and upper secondary schools employ only scholastic aptitude as the standard to evaluate the applicants. One argument is that if each university and upper secondary school creates its own standard to determine student ability, thus diversifying standards, the situation will improve to some extent. However, it is doubtful if people would approve the idea of giving much weight to interviews or to judging applicants by their performance in extra-curricular activities, as those are less objective than a scholastic aptitude examination.

(3) Knowledge cramming

It has been said that it is necessaruy to avoid cramming fragments of knowledge into students and to provide them with an education that cultivates their creativity. Yet there are no ideas about how to change the present system and to develop creativity in students.

(4) Objective of education

The objective of education has to be changed along with changes in society. Yet changing the objectives of education means rearranging the existing subjects. Each organization for the teaching of a subject is a powerful political pressure group, and thus it is relatively easy to increase the amount of time for teaching a subject, but it is hard to decrease it.

(5) Unfavorable behavior

The problems of juvenile delinquency and school violence are serious. Since most of the students who cause problems are not doing

well at schools, it is necessary to help them understand subjects. Although moral education and home education have to be emphasized, it is hard to get national consent on this issue because opinions depend on the value standards of each individual.

(6) Lack of internationality

There is an argument that in the age of internationalization, it is important to study foreign languages from an early stage of formal education. At the same time, however, it is also important to know the culture and history of Japan and to cultivate patriotism in order to become able to talk about the country properly. Yet this idea could fall into nationalism.

(7) Quality of Teachers

While there is an opinion that a system which requires teachers to be trained at the graduate school level in order to have teachers of high quality, some people stress that anyone should be able to become a teacher as long as he is motivated.

(8) Tendency of giving too much importance to academic career

One of the factors which caused the ordeal of examinations is that the idea of going from prestigious universities to prestigious enterprises is a strongly held belief. In actuality it is hard to work for a prestigious enterprise if one does not graduate from a prestigious university. Under the lifelong employment system, one's potential ability is the only factor to be considered when enterprises judge their applicants, and a degree from a prestigious university is supposed to prove the intellectual quality of an applicant. The situation will change if enterprises hire unique graduates of various universities, but the government cannot force them to do so.

## V. OVERVIEW AND CONCLUDING REMARKS

The environment of Japanese education has been greatly changed. The most fundamental fact, however, is that except for technical problems most of the shortcomings of education are also those of the society. Educational reform takes time because changing only education itself is not enough.

In many countries, competition for enrollment at prestigious schools exists. One of the reasons that it is very keen in Japan is that many people believe that if one fails to enter a prestigious university at the age of 18 or 20, there is no way to catch up with others. According to a survey conducted by the Economic Welfare Bureau of the Economic Planning Agency (1984), people responded to the question, if it is possible to start over and succeed by changing jobs or going back to school after graduation from the university and working for awhile, would you do it?: 24.3% answered "Yes" and 43.0% answered "No". The more education, the more the individual is likely to answer "No"; 52.6% of university graduates answered "No". It is widely believed that the society of Japan is not for the people who have to or wish to start over again.

Lifelong education is a device to cope with these circumstances. It will become more necessary to keep studying through life, and opportunities for lifelong education will diversify in the future. The role of education also has to change. Elementary and secondary education has to be promoted to produce well-rounded children sound in mind and body, who have a well-balanced moral sense and sufficient level of fundamental scholastic aptitude. Even at vocational programs of upper secondary schools, acquisition of the ability to adapt to changing industry and society is stressed more than skills and knowledge in a specific job area. The same educational policy can be seen in higher education as well; few people believe that what is studied at universities directly helps the graduates in their career.

Job skills are acquired at programs of training and education offered by companies, at vocational schools, or in special training schools, whose curricula directly meets the needs of the society. Special training schools are expanding; 10.5% of upper secondary school graduates entered such schools in 1984.

In Japan, which is homogeneous both racially and culturally, excessive egalitarianism has brought uniformity in all aspects of education. The uniform education produced a uniform work force, which was the generative power to catch up with western countries after World War II. However, now the country has become a highly developed information society which needs people with creativity and unique ideas. Education cannot be independent of this tendency. In order to cultivate people's creativity, education has to seek diversification to some degree. The lifelong employment system, based upon a pyramidal population structure with a small number of highly educated people, has to change due to an increase in the number of aged and educated workers. People have to continue learning and developing their ability as their own responsibility. It is time for each institution and individual to develop their own characteristics. Renovation of education is a hot issue in Japan, and changing peoples' expectations of education is necessary in combination with efforts made by the government.

Appendix

# EDUCATIONAL SYSTEM OF JAPAN

## 1. School Education System

With the reform of the education system after World War II, Japan adopted the 6-3-3-4 single-track system throughout the country. Figure A-1 shows the education system in Japan.

### (1) Compulsory Education

Six years in elementary school and three years in lower secondary school are compulsory with a common curriculum. Local public schools must admit any child who is living within a given attendance area and there is no selection procedure.

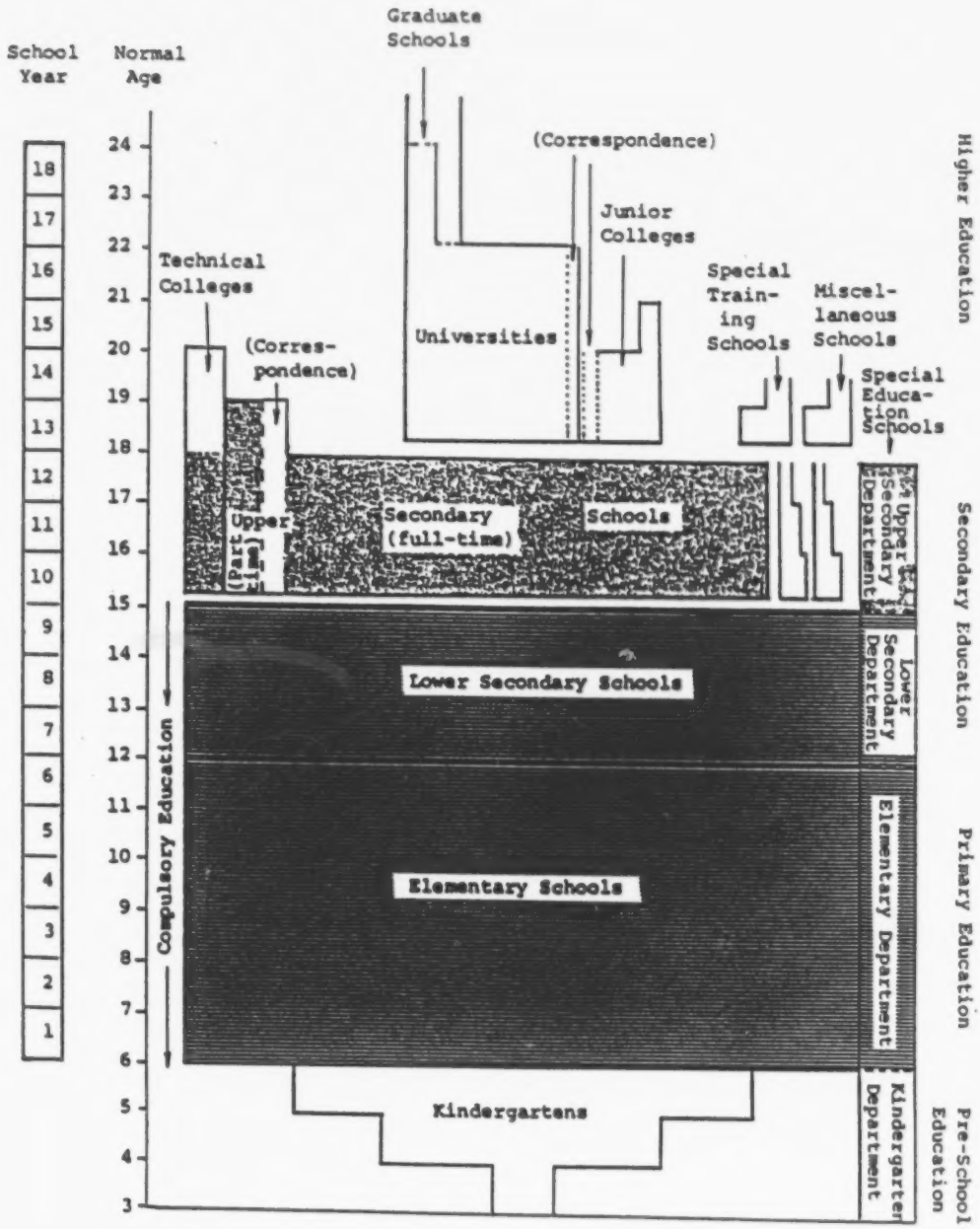
### (2) Upper Secondary Education

Upper secondary schools have a full-time course for three years and also a part-time course and a correspondence course both for four years and more. The courses are further classified into general and vocational courses such as agriculture, industry, commerce, homemaking and others, varying according to the curriculum of each school. In May 1984, approximately 71% of all upper secondary school students were enrolled in general courses. Admission to the individual schools is usually granted on the bases of credentials from the lower secondary schools and an entrance examination.

### (3) Higher Education

There are three types of institutions for higher education: universities, junior colleges and technical colleges. Universities offer both undergraduate and post-graduate courses. Undergraduate courses leading to the bachelor's degree last 4 years, except for medical and dental courses which last 6 years. Post-graduate courses include master's degree course (two or more years) and doctor's degree course (five or more years).

Figure A-1. Educational System of Japan



Junior colleges offer two or three-years education. Technical colleges require for admission the completion of the lower secondary course and offer five-year full-time courses for the training of technicians.

Universities and junior colleges select their entrants on the basis of an entrance examination and credentials from the upper secondary schools. As for national and local public universities, the "Joint Achievement Test", a unified examination designed to assess the general and basic upper secondary school attainment of the applicants, was introduced as the first of a two-stage entrance examination system from the 1979 academic year. The second stage is a test given by the individual institutions themselves to determine the final selection of entrants.

Some institutions of higher education, based on new ideas, free from traditional concepts, were established, namely, the University of Tsukuba, Universities of Technology and Science, Universities of Teacher Education, the University of Library and Information Science, and the University of the Air.

(4) Special Training Schools and Miscellaneous Schools

There are a variety of special training schools and miscellaneous schools outside the formal school system which provide vocational education. Most of them provide young people with short-term vocational and practical courses in dressmaking, cooking, bookkeeping, typing, design, foreign languages, automobile mechanics, electronics, computer programming, etc. The School Education Law was partially revised in 1975, and a system to authorize miscellaneous schools complying with certain standards and scales as special training schools was introduced.

Special training schools are schools which aim at developing abilities useful for practical and professional life or at the general enhancement of intelligence, and which have courses longer than one year with more than 800 class-hours a year and more than 40 students.

The enrollment in special training schools has increased. The number of these schools is 2,935 (88 % of which are privately run), and the number of students is 536,457 in 1984. This shows the

diversity of education provided by special training schools. In order to promote further this type of education, the Japan Scholarship Foundation started in 1980 to expand its service of offering scholarship loans to needy students. In addition, the government subsidizes in-service training of teaching staff, and the Japan Private School Promotion Foundation has made loans to such schools on a larger scale.

Special training schools can be regarded as representative of post-secondary education, [illegible] that they meet the needs of society and the needs of those students who want to obtain special skills and techniques for a profession. Unlike the university curricula, in which divisions and departments are formed according to systematic scientific criteria, the curricula at special training schools have a wide variety, because they are based on the variety of industrial and professional structures. In addition, it is expected that the professional structures will become more varied and differentiated in the future. In accordance with this change, the nature and constitution of special training schools will become much more varied and differentiated than before.

### (5) Standard of Education

The number of schools is shown in table A-1. The level of quantitative development of education in Japan is indicated in table A-2, which shows the proportion of the age group enrolled in formal education at different levels.

## 2. School Curricula

An ordinance of the Ministry of Education, Science and Culture entitled "Enforcement Regulation for the School Education Law" lays down the names of the subjects to be offered and the standard number of school hours per year for each subject in elementary and lower secondary schools. The basic aim of each subject and the objectives and standard contents of instruction given in each grade for each subject are outlined in the "Courses of Study" issued by the Ministry.

Table A-1. Number of Schools (as of May 1, 1984)

| School Level | Institutions | * Teachers | Enrollment |
|---|---|---|---|
| Kindergartens | 15,211 | 99,173 | 2,132,681 |
| Elementary Schools | 25,064 | 468,675 | 11,465,108 |
| Lower Secondary schools | 11,047 | 278,931 | 5,829,300 |
| Upper Secondary Schools | 5,427 | 258,626 | 4,891,917 |
| Special Schools for Handicapped | 902 | 38,192 | 94,871 |
| Technical Colleges | 62 | 3,772 | 47,527 |
| Junior Colleges | 536 | 17,422 | 380,214 |
| Universities | 460 | 110,662 | 1,843,152 |
| Special Training Schools | 2,935 | 23,521 | 536,457 |
| Miscellaneous Schools | 4,476 | 22,782 | 580,060 |

* full-time

Source: Ministry of Education, Science and Culture
SChool Basic Statistics, 1984

Each school organizes its own curricula in accordance with the "Course of Study", giving due consideration to local needs and to the stage of pupils' development and experience.

Table A-3 and A-4 show the standard school hours per year in elementary and lower secondary schools.

For upper secondary schools, the objectives and standard contents of each subject, as well as the standard number of "credits" to be acquired, are laid down in the "Course of Study for Upper Secondary Schools". According to the revised "Course of Study," the total number of credits required for graduation has been reduced from 85 to 80, with a view to reducing burden of students.

Table A-2. Enrollment Ratio (Male and Female)

(as of October 1, 1980) %

| age | kinder-garten | nursaey school | elementary and lower secondary school | upper secondary school | technical and junior college | univer-sity and guradu-ate school | Total |
|---|---|---|---|---|---|---|---|
| 0 | - | 1.44 | - | - | - | - | 1.44 |
| 1 | - | 5.48 | - | - | - | - | 5.48 |
| 2 | - | 11.93 | - | - | - | - | 11.93 |
| 3 | 4.88 | 23.71 | - | - | - | - | 28.59 |
| 4 | 32.17 | 34.69 | - | - | - | - | 66.87 |
| 5 | 59.12 | 34.71 | - | - | - | - | 93.83 |
| 6 | 33.33 | 15.90 | 48.95 | - | - | - | 98.17 |
| 7 | - | - | 99.64 | - | - | - | 99.64 |
| 8 | - | - | 99.86 | - | - | - | 99.86 |
| 9 | - | - | 99.92 | - | - | - | 99.92 |
| 10 | - | - | 99.91 | - | - | - | 99.91 |
| 11 | - | - | 99.93 | - | - | - | 99.93 |
| 12 | - | - | 99.94 | - | - | - | 99.94 |
| 13 | - | - | 99.95 | - | - | - | 99.95 |
| 14 | - | - | 99.95 | - | - | - | 99.95 |
| 15 | - | - | 50.89 | 46.41 | 0.46 | - | 97.76 |
| 16 | - | - | 0.61 | 93.14 | 0.99 | - | 94.73 |
| 17 | - | - | 0.37 | 91.82 | 1.03 | - | 93.22 |
| 18 | - | - | 0.28 | 47.21 | 10.62 | 9.03 | 67.14 |
| 19 | - | - | 0.12 | 3.34 | 19.28 | 20.93 | 43.66 |
| 20 | - | - | 0.06 | 0.84 | 11.66 | 24.76 | 37.32 |
| 21 | - | - | 0.06 | 0.29 | 3.09 | 25.38 | 28.83 |
| 22 | - | - | 0.03 | 0.14 | 1.30 | 18.70 | 20.17 |
| 23 | - | - | 0.02 | 0.09 | 0.63 | 8.50 | 9.24 |
| 24 | - | - | 0.01 | 0.06 | 0.35 | 3.70 | 4.13 |
| 25 or more | | | - | 0.01 | 0.02 | 0.11 | 0.14 |

Source: National Census, 1980

Table A-3. Standard School Hours per Year in Elementary Schools

| Classification | 1st | 2nd | 3rd | 4th | 5th | 6th |
|---|---|---|---|---|---|---|
| Japanese Language | 272 | 280 | 280 | 280 | 210 | 210 |
| Social studies | 68 | 70 | 105 | 105 | 105 | 105 |
| Arithmetic | 136 | 175 | 175 | 175 | 175 | 175 |
| Science | 68 | 70 | 105 | 105 | 105 | 105 |
| Music | 68 | 70 | 70 | 70 | 70 | 70 |
| Art and Handicrafts | 68 | 70 | 70 | 70 | 70 | 70 |
| Homemaking | - | - | - | - | 70 | 70 |
| Physical Education | 102 | 105 | 105 | 105 | 105 | 105 |
| Moral Education | 34 | 35 | 35 | 35 | 35 | 35 |
| Special Activities | 34 | 35 | 35 | 70 | 70 | 70 |
| Total | 850 | 910 | 980 | 1,015 | 1,015 | 1,015 |

Note: One unit school hour represents 45 minutes

Source: Ministry of Education, Science and Culture
Course of Study for Elementary Schools in Japan, 1983

Table A-4. Standard School Hours per Year in Lower Secondary Schools

| Classification | 7th | 8th | 9th |
|---|---|---|---|
| Japanese Language | 175 | 140 | 140 |
| Social Studies | 140 | 140 | 105 |
| Mathematics | 105 | 140 | 140 |
| Science | 105 | 105 | 140 |
| Music | 70 | 70 | 35 |
| Fine Arts | 70 | 70 | 35 |
| Health and Physical Education | 105 | 105 | 105 |
| Industrial Arts or Homemaking | 70 | 70 | 105 |
| Moral Education | 35 | 35 | 35 |
| Extra Curricula Activities | 70 | 70 | 70 |
| Elective Subjects and Others | 105 | 105 | 140 |
| Total | 1,050 | 1,050 | 1,050 |

Note: One unit school hour represents 50 minutes.

Source: Ministry of Education, Science and Culture,
Course of Study for Lower Secondary Schools in Japan, 1983

EMPLOYMENT SYSTEM AND VOCATIONAL TRAINING

## 1. Employment System of Japan

The following three are considered to be characteristics of Japanese employment system.

(1) Lifelong employment system

Full-time workers may and are expected to keep working until they reach the retirement age.

(2) Seniority wage system

Salary and other wages are decided according to the age of the employee and the number of years of employment in the company. The longer the employee works for the company, the more he tends to keep his job.

(3) Enterprise union

Most unions are not trade unions but are enterprise unions which are organized by all the permanent workers of each company.

In actuality, however, various systems are practiced at companies. The lifelong employment system is a relatively new system which was started in the process of modernizing Japan in order to secure skilled workers who were in short supply those days and eventually took root to be a social norm. Enterprises may dismiss workers when business is depressed, and the number of temporary workers whose status is not well guaranteed is rather large.

In general, employment adjustment are done by reduction of overtime work, work-sharing, reassignment, reduction of the number of workers to recruit, loan of employees and dismissing of part-time workers. The labor force is quite flexible.

The seniority wage system is also modified. Employees' productivity makes a big difference on their wages as well as on the speed of promotions. Leaving rate almost reaches 20% among young workers.

The enterprise union is not controlled or organized by the company. Decisions on management policies, wages and others are made by negotiation of labor and management.

The Japanese employment system is thus rational although it is affected by the history and culture of the country. These features which are regarded as Japanese will change according to the changes of society and economics.

## 2. In-House Education

Programs of training and education have been extensively offered by enterprises. In April enterprises recruit university graduates for the year and educate them in classroom and on-the-job training in order to develop the right people.

Japan started its modernization later than western countries, but introduced and applied their know-how of technological development. Rapid industrialization caused the need for a large labor force, and at the first stage of industrialization the farming population was the source of labor supply. Like it or not, it was necessary for companies to train their workers.

An internal labor market is formed in companies due to the lifelong employment system and the seniority wage system. Higher level jobs are taken by promoted workers, and the labor force drawn from the external labor market into the internal labor market is for the lowest level jobs in the organization.

Under these circumstances programs of training and education have played an important role in raising productivity and assigning the right people to the right places. Regular recruitment of new graduates in April is very important under the lifelong employment system because it is difficult for companies to fire people for anything less than a major criminal offense. At recruitment, one's potential ability is regarded as more important than the knowledge or skills he has then. School career provides objective information as to how to judge potential ability. Small companies have to recruit irregularly because it is difficult for them to hire capable new graduates. In

general, to change jobs means to take a lower-level job and is not regarded as beneficial either socially or economically.

After the mid-1960s, enterprises stopped recuiting lower secondary school graduates and started hiring upper secondary school graduates as factory workers because the ratio of students who go on to upper secondary school rose, and it became impossible to recruit enough workers among the capable lower secondary school graduates.

Usually new employees are assigned several jobs at stated periods for experience. White-collar staffs, who are expected to take administrative posts are more likely to rotate into many different jobs so that they will learn about the organization of the enterprise. This system also helps to develop good relationship among workers in different departments. Blue-collar workers are also rotated into several work places but the areas of work is limited. Thus employees find the most suitable jobs while they experience different tasks, and are eventually promoted in the field in most cases.

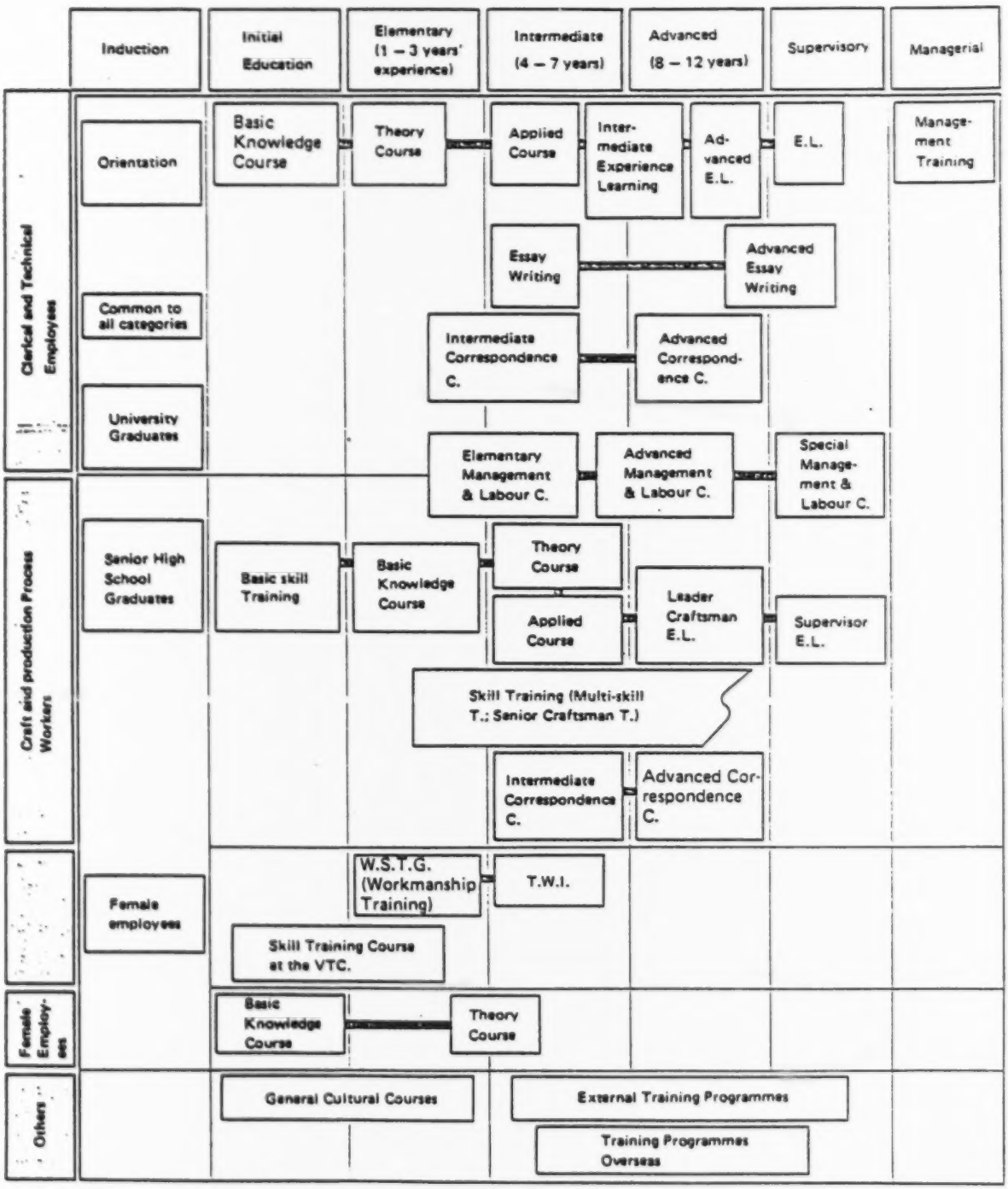
The money and time that companies spend on educating employees are huge, but as long as the workers keep working for the company it gains profits corresponding to the expenditure.

Programs of education and training have something to do with ranks of jobs, status, and wages. In-house education aims to develop not only the specific skills which are required in a particular job, but also potential ability of each individual. This is a rational behavior under the internalized structure. Workers are motivated and become more sensible of their responsibility.

In-house education is related to promotion. Examination systems and other standards have been developed to standardize promotion according to the agreement between labor and management. Nowadays the number of years of employment for the company does not necessarily assure promotion. Figure A-2 shows an example of the system of in-house training programs.

According to a survey conducted by the Ministry of Labor, Vocational Training Bureau, 57.8% of enterprises offered off-the job training; 98.6% of these enterprises had more than 1,000 employees.

Figure A-2. An Example of the Emploees Training in One of the Automobile Companies




Source: Ishikawa, Toshio, Vocational Training, The Japan Institute of Labor 1981

### 3. Public Vocational Training

In many cases small- and medium-scale companies which cannot afford training accommodations depend on governmental vocational institutions for training. Public vocational institutions offer chances to develop skills for people who want to change jobs or to look for another job after their mandatory retirement.

Generally speaking, public vocational programs fall into two types; some programs are directly conducted by prefectures or the Employment Promotion Project Corporation at public vocational schools, the others are conducted by each enterprise, being supported by the government. These are administered in accordance with the provisions of the Vocational Training Law which was originally enacted in 1958.

Public vocational schools are not fully utilized because they tend not to catch up with changing technology and needs of society, but programs conducted by enterprises have been effective and are appreciated.

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